

## Reply to Reviewer #1 (Stephen Hicks)

### 1. SUMMARY

This manuscript by Cannata et al. analyses the effect of COVID-19 lockdowns on seismic noise in Sicily, Italy. Although this effect has been reported globally, this study is unique because uses a fairly dense regional seismic network to view the higher-order features of the anthropogenic lockdown signal and its spectral characteristics. The study finds quite a heterogeneous lockdown response, even on a relatively small island. Most interestingly perhaps, it is also found that the anthropogenic noise reduction might also have allowed for more detection of seismic arrivals from seismic events. I enjoyed reading this manuscript. The writing is very clear and contains minimal errors.

I congratulate the authors on a very nice study. Overall, the manuscript is in excellent shape, and aside from some minor comments detailed below, it should be close to publication-quality. My most significant comment is that I think the description of the seismicity detection results should be expanded a little.

> *We thank the reviewer for the very positive comments.*

### 2. MINOR GENERAL COMMENTS

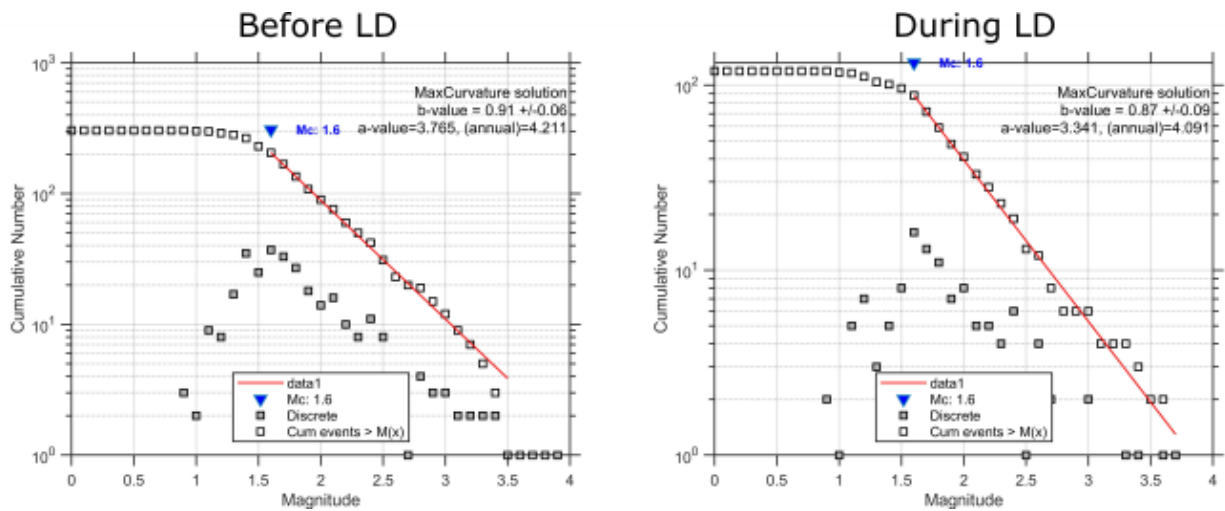
1) The analysis of the earthquake detections is interestingly, yet somewhat disappointingly short. I recommend a few things:

- First of all, this aspect of the paper is not yet mentioned in the abstract, so I would add some mention of it there.

- Second, I would recommend perhaps not having a separate methods subsection on the earthquake detection. I would move this short description of the detection system along with the results to a separate subsection of the Discussion called something like "Implications of the lockdown for detection of seismicity".

- Finally, I think is much scope for further analyses of the seismicity detection changes. For example, for Figure 11, I could expect that if the improve the detectability of seismic phases during lockdown is robust, then it should be seen most clearly for seismic events occurring during the daytime. How does the correlation look if you only plot seismic events from during the daytime (e.g 0600-1800)? Also, if you were to assess a Gutenberg-Richter relationship and to compare pre- and during-lockdown, would you be able to infer a lower completeness magnitude? Finally, are you able to determine which stations had more P-picks during the lockdown, if so, were these the noisier stations, e.g. "EFIU"?

> *We tried to repeat the analysis by considering only earthquakes recorded during day-time and weekdays, but the number of events became very low (25 and 85, during and before lockdown, respectively), to be statistically significant. In addition, we also evaluated the Gutenberg-Richter relationship separately for earthquakes, taking place during and before lockdown, and we did not note any significant changes in the completeness magnitude, equal to 1.6 in both cases:*



Hence, these further analyses did not allow to get more robust results. Probably, this topic would need a more in-depth analysis. Following the advice of the reviewer #2, we decided to delete this section regarding the detection improvement and keep it for a next narrower, more focused study.

2) Is there any specific reason why your frequency analysis only goes up to 30 Hz, when your stations were sampling data to 100 Hz, so possibly allowing you to get close to 50 Hz? It might be interesting to see what is happening with the anthropogenic seismic wavefield at higher frequencies.

> Thanks for your advice. We extended our analysis up to 40 Hz, and consequently most of the figures/analyses have been updated. We could not go beyond 40 Hz, because of the digitizer anti-aliasing low-pass filter with cut-off frequency around 40-45 Hz (it depended on the station taken into account).

### 3. MINOR SPECIFIC COMMENTS

- L35: "Between 8-11 March, the entire country was put under lockdown (Gatto et al., 2020)". This phrasing makes it sound like the country was on lockdown for 3 days between the 8 and 11 March. Please rephrase, including the approximate total length of lockdown.

> Done, thanks.

- L55: I guess it would be good to use the opportunity in this paragraph to state why your study is different and complementary to the existing COVID-19 seismic noise studies. I guess yours is the first study that uses a fairly dense network from a local area in which lockdown restrictions were imposed uniformly. So, it gives us the opportunity to view higher-resolution details of the anthropogenic noise field (e.g. how the anthropogenic noise field propagates, site effects, frequency effects, etc.), with a uniform lockdown and independent of potential cultural variations.

> We added a sentence in that paragraph, highlighting the peculiarity of this study. Thanks for your advice.

- L65: You mention the seismometer instrument type, but it would be good to describe the station installation styles and environments given that you are looking at a local scale case study. Are all stations deployed in subsurface vaults? Or is there a more variable installation style? Are some stations located in populated areas, or are they in as remote regions as possible? Or is the installation style quite mixed over the network?

> *The installation style is pretty uniform, all the considered stations are installed in shallow vaults (depth ~1.5 m) made of concrete. As for the site conditions (in terms of possible anthropogenic seismic sources), it is variable: some are close to towns or highways, others near agricultural areas, others in small islands or on the flanks of Mt. Etna. All these information have been added in the manuscript, as well as in the new Table 1.*

- L170: I find this sentence a bit confusing: "The correction was performed by dividing the number of phases by the fraction of seismic data acquired by the network during the day when the earthquake took place, with respect to the data which would have been recorded in case of full operating state of the network (Figure 11b)". Does that mean the y-axis of Figure 11b is essentially a percentage value? Could you maybe please clarify this?

> *As mentioned above, this topic would need a more in-depth analysis. Following the advice of the reviewer #2, we decided to delete this section regarding the detection improvement and keep it for a next narrower, more focused study.*

- Figure 1: Some of the station text labels are quite small, overlapping, and so are hard to read. Please increase the font size and edit the label positions to make sure they do not overlap. -> Please also include a small inset map for readers who may not know where exactly Sicily is :) -> It might also be useful to include some topographic shading to emphasise the position and flanks of Mt. Etna.

> *Done.*

- Figure 2: -> If the paper is printed on A4 paper, some of the text labels could be very small. Maybe consider increasing each subplot size and reduce the whitespace between subplots? -> The "LD" label is very hard to see. Maybe increase the font and put this in a semi-transparent box. -> The x-axis tick intervals are a bit random. Maybe just show the 1st day of each month for clarity.

> *Done.*

- Figure 3: -> The "LD" label is very hard to see. Maybe consider increase the font and put this in a semi-transparent box.

> *Done.*

- Figure 4: -> What is the order of the stations on the y-axis? If these are in no particular order then maybe using alphabetic order might be useful so that readers can easily crosscheck the station results with other figures. -> The "LD" label is very hard to see. Maybe increase the font and put this in a semi-transparent box.  
> *The stations are sorted by decreasing latitude (it is indicated in the caption). We increased the font size of "LD" to make it more visible.*

- Figure 5: -> Some of the station text labels are quite small, overlapping, and so are hard to read.  
> *Done.*

- Figure 6: -> If the paper is printed on A4 paper, some of the text labels could be very small.  
> *Done.*

Figure 7: -> If the paper is printed on A4 paper, some of the text labels could be very small.  
> *Done.*

Figure 9: -> The figure resolution is very low so I cannot read the text labels in the legend.  
> *We increased the resolution, and changed a bit the figure based on the advices of the reviewer #2.*

Figure 11: -> Change the y-axis labels from "# picking" to "Number of P-picks".

> *As above mentioned, we deleted this section regarding the increased detectability of earthquakes, and then also the related figure.*